



**ENVIRONMENTAL
MANAGEMENT
and
ENRICHMENT
FACILITIES**

**The Portsmouth Site Response to the
Secretarial Initiatives on Chemical
and Radiological Vulnerabilities**

Portsmouth Gaseous Diffusion Plant

November 1997

MANAGED BY
LOCKHEED MARTIN ENERGY SYSTEMS, INC
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

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ACRONYMS, ABBREVIATIONS, AND INITIALISMS

ABD	Authorization Basis Documents
DNFSB	Defense Nuclear Facilities Safety Board
DOE	U.S. Department of Energy
DOE-ORO	DOE Oak Ridge Operations Office
EMEF	Environmental Management and Enrichment Facilities
ESAMS	Energy Systems Action Management System
ES&H	Environment, Safety, and Health
HEU	Highly Enriched Uranium
LMES	Lockheed Martin Energy Systems, Inc.
OSHA	Occupational Safety and Health Administration
PAAA	Price-Anderson Amendments Act
PCB	Polychlorinated Byphenyl
PORTS	Portsmouth Gaseous Diffusion Plant
RCRA	Resource Conservation and Recovery Act
SAR	Safety Analysis Report
WSS	Work Smart Standards

EXECUTIVE SUMMARY

The Portsmouth Site responses to the Secretary of Energy Initiatives following the chemical explosion at Hanford on May 14, 1997, are included in this report.

This report involved a reevaluation and review of vulnerabilities and audit findings identified in recent, applicable Lockheed Martin or DOE assessments and audits of site facilities. Responses to Defense Nuclear Facilities Safety Board (DNFSB) recommendations were also included in the scope of the review.

The audits and evaluations examined in this review identified nine vulnerabilities which have been provided in Appendix A. No new vulnerabilities were identified, and the risks associated with open corrective actions do not present any imminent dangers.

1. INTRODUCTION

1.1 Purpose of Report

As a result of the explosion in the Chemical Preparation Room at the Hanford Plutonium Reclamation Facility (PRF) on May 14, 1997, Secretary Federico Peña directed the U.S. Department of Energy (DOE) Operations Office Managers to implement several broad initiatives with the purpose of identifying and preventing similar situations. Four specific initiatives were identified in the August 4, 1997, letter from Secretary Peña. Only the first two initiatives are required to be covered in this Portsmouth Site specific report. The last two initiatives are covered from Portsmouth participation as a part of the Environmental Management and Enrichment Facilities (EMEF) Business Unit.

Initiative One:

DOE site contractors must scrutinize their use or storage of any chemicals that have the potential for explosion, fire, or significant toxic release, and must promptly dispose of unneeded chemicals in accordance with safety requirements and environmental regulations. DOE field offices should develop an approval process to assure the disposal or safe and environmentally compliant storage and handling of such chemicals that are retained.

Initiative Two:

DOE field offices must reassess known vulnerabilities (chemical and radiological) at facilities that have been shut down, are in standby, are being deactivated, or have otherwise changed their conventional mode of operation in the last several years. Facility operators must evaluate their facilities and operations for new vulnerabilities on a continuing basis.

Initiative Three:

DOE and contractor field organizations with operational responsibilities must assess the technical competence of their staffs to recognize the full range of hazards presented by the materials in their facilities, act on results, and implement training programs where needed.

Initiative Four:

DOE field offices must assess their site Lessons Learned and Occurrence reporting programs to assure that 1) outgoing information is well characterized and properly summarized, and 2) incoming information is thoroughly evaluated, properly disseminated, appropriately implemented, and tracked through formal management systems.

Introduction

1.2 Site Description

The Portsmouth Gaseous Diffusion Plant (PORTS) is located on a 3,714 acre Federal reservation 112 kilometers south of Columbus, Ohio. Historically, the plant was built in 1952 by the Atomic Energy Commission to produce enriched uranium for Government programs and commercial nuclear power plants at levels ranging from a few percent to almost 100 percent uranium 235. In 1991, production of Highly Enriched Uranium (HEU) was terminated, and the plant mission changed to uranium enrichment for commercial reactors.

The Energy Policy Act of 1992 transferred responsibility for Portsmouth enrichment activities from DOE to a newly created entity, the United States Enrichment Corporation (USEC). The enrichment facilities are leased from DOE by USEC. The goal of the Corporation is full privatization of the United States Uranium Enrichment Enterprise.

On July 1, 1993, management of the uranium enrichment operations at PORTS was transferred from the DOE to USEC. The DOE continues to have responsibility for environmental restoration of DOE retained areas and waste management activities of legacy materials at the plant. Lockheed Martin Energy Systems, Inc. manages the environmental restoration, waste management, and HEU efforts for the DOE. Lockheed Martin Utility Services, Inc. serves as the contractor to the United States Enrichment Corporation for uranium enrichment operations.

Currently, DOE focuses on an overall mission related to environmental management, disposal of HEU, management of the depleted uranium hexafluoride cylinders under DOE responsibility, regulatory oversight, and lease management for the facility. Oversight of cleanup activities at PORTS is being provided by consent agreements initially signed in 1989 with the state of Ohio and the U. S. Environmental Protection Agency (U.S. EPA). The U.S. EPA has authorized the Ohio Environmental Protection Agency (Ohio EPA) to oversee cleanup actions at the plant under a Amended Administrative Consent Order that was signed in August 1997 by the Department of Energy, U. S. Environmental Protection Agency, Ohio Environmental Protection Agency, and the Ohio Attorney General's Office.

Corrective actions are being performed at the Portsmouth facility in compliance with primarily the Resource Conservative and Recovery Act (RCRA), a federal law enacted in 1976 to ensure the safe treatment, storage, and disposal of hazardous wastes. The RCRA corrective action process involves a phased cleanup approach: RCRA Facility Assessment (RFA), RCRA Facility Investigation (RFI), Corrective Measures Studies, and Corrective Measures Implementation.

The Portsmouth program has been very successful in developing innovative cleanup technologies and cultivating excellent relationships with both the state and federal regulators as well as providing an openness with local citizens and stakeholders. Efficiency and planning during peak environmental construction years resulted in devoting 68% of the environmental management budget to actual site remediation and waste handling, 24% for studies and investigations, and only 8% for management costs. Efforts to bring new economics opportunities and reindustrialization to the area are in progress.

2. INTEGRATED SAFETY MANAGEMENT SYSTEM AND WORK PLANNING

2.1 Integrated Safety Management

Implementation of Integrated Safety Management System (ISMS) at PORTS follows the plans for the EMEF business unit. The draft EMEF ISMS Plan was submitted to DOE on October 31, 1997. The EMEF ISMS is based on the seven guiding principles and five core functions contained in DOE Policy 450.4, Safety Management System Policy, Work Smart Standards (DOE P 450.3), and Enhanced Work Planning. Successful deployment of the EMEF ISMS is full integration of these requirements into a standard, business unit-wide process for planning, endorsing, executing, and closing out all work performed. The process EMEF has adopted to lead this integration initiative is the Project Delivery System. The requirements of ISMS have been incorporated into the Project Delivery System, and it is currently being implemented across the business unit. The EMEF ISMS incorporates a tailored approach to work planned at all levels.

The EMEF ISMS also integrates many current initiatives, such as Enhanced Work Planning (EWP), and Work Smart Standards (WSS). The ISMS described herein reflects a mature system that, when fully implemented, will ensure the protection of the workers, the public, and the environment. The overall framework for the EMEF ISMS is organized around the following five core functions:

Define the Scope of Work

Define the scope of work consists of translating the mission objectives into a definition of work that will meet those objectives, identifying expectations for the performance of work, and allocating resources to ensure that work is performed safely. Strategic direction is defined through a formal and rigorous process by DOE and contractor senior management and their staff. Missions are separated into projects for each specific site remediation or facility operations. These projects are further divided into tasks or activities.

Identify and Analyze the Hazards

Analyze the hazards involves identifying and analyzing the hazards and risks to the workers, the public, and the environment associated with the planned work activities. Hazard identification and analysis are performed by teams that may include workers, supervisors, subject matter experts, and analysts.

Develop and implement hazard controls

ISMS and Work Planning

Develop and implement hazard controls includes identifying standards and requirements, identifying and establishing hazard controls, and implementing the controls. EMEF uses standards to set Environment, Safety, and Health (ES&H) requirements. Standards are selected using the WSS Process, as defined in DOE Manual (DOE M) 450.3-1, *The Department of Energy Closure Process for Necessary and Sufficient Sets of Standards*. Teams of Lockheed Martin Energy Systems, Inc. (LMES) personnel collected hazard data from EMEF planned work. These teams used the WSS process described in DOE P 450.3 and DOE M 450.3 to select the standards for protecting the workers, the public, and the environment. The teams include front-line workers, line management, and subject matter technical experts. The WSS are reviewed and approved by top LMES management and DOE and are incorporated into the contract between DOE and LMES. LMES and EMEF-level health and safety policies, procedures, and programs are based on the WSS.

Perform Work

Perform work contains the need to adequately prepare for work, confirm readiness, perform work safely, and establish performance measures. Specific mechanisms are selected using a tailored approach. ES&H controls are implemented through the task level work control process. EMEF uses the following types of mechanisms to communicate work requirements and ES&H controls to the work team:

- Project plans
- Work permits
- Procedures
- Work packages
- Health and safety and environmental compliance plans
- Activity Hazard Analyses
- Work instructions
- NEPA reviews
- Signs
- Training
- Contracts

Each employee involved in performing or monitoring the work can stop the work if changes occur that are outside the authorized scope of work or if there is a question about the ability to safely perform the task.

To measure performance, ES&H goals and objectives are established and monitored at each level in the business unit and at its subcontractors. ES&H goals and objectives correspond with the individual health and safety plan developed as guidance for the business unit and for each of its

organizations. For EMEF subcontractors, ES&H performance incentives and measures are included in the specific subcontracts.

Provide Feedback and Continuous Improvement

Provide feedback and continuous improvement includes the collection of feedback information, identification of improvement opportunities, changes to improve performance and oversight and enforcement. Feedback is captured through multiple mechanisms as described in Section 4.4.

EMEF changes processes and revises support to task supervisors to improve performance. These changes are controlled and tracked through the issues management action plans.

2.2 Enhanced Work Planning Process

Hazard characterization provides information pertaining to the chemical, physical, and biological hazards associated with potential exposures which may be encountered at a work site. Several different techniques and levels are employed at PORTS using a multidisciplinary team approach.

At the project level, the Existing Facility Hazard Analysis (EFHA) Program involves hazard analysis through checklists completed by the Industrial Hygiene, Industrial Safety, and Health Physics disciplines. These checklists assist with the identification of hazards as they currently exist at a facility or prospective project site (underground utilities, overhead power lines). The Activity Hazard Analysis (AHA) concentrates on the work activity, the potential hazards and any actions, controls or methods required for compliance. The Job Hazard Analysis (JHA) identifies and documents the individual steps and sequence in which the specific job is performed. This applies to any new job, routine and non-routine jobs and any job which has an accident history. The team members for the JHA include the line supervisor, a representative worker and a subject matter expert.

Occupational Safety and Health Administration (OSHA) Inspections are conducted on a weekly basis and provide feedback to the facility owners on compliance issues. Each noncompliance is given a Risk Assessment Code (RAC) which determines the severity and the probability of the injury or illness occurring. Deficiencies are tracked through a database until they are abated and verified as closed. All of the above mentioned assessments provide information on the nature of the workplace so that individuals will have the information needed to plan, perform and assess safe conduct of work at PORTS.

2.3 Site Operations Review Committee

A Site Operations Review Committee (SORC) has been established to provide an advisory function and process for objective and critical review of operational matters pertaining to the PORTS EMEF activities. The objective of the reviews are adequacy of the work plans in identifying hazards or vulnerabilities and adequacy in control and mitigation of the hazards for worker, public, and environmental safety. If adequate work planning does not support safe conduct of the work, the work is not approved to start until corrective actions are completed. These reviews provide PORTS management with additional assurance that worker, public, and environmental safety has been adequately integrated into work plans.

3. USE, STORAGE, AND DISPOSAL OF CHEMICALS AND WASTE

This chapter responds to the first initiative addressed in the August 4, 1997, directive from Secretary Federico Peña that reads as follows:

DOE site contractors must scrutinize their use or storage of any chemicals that have the potential for explosion, fire, or significant toxic release, and must promptly dispose of unneeded chemicals in accordance with safety requirements and environmental regulations. DOE field offices should develop an approval process to assure the disposal of safe and environmentally compliant storage and handling of such chemicals that are retained.

3.1 Waste Storage And Disposal Program

3.1.1 System Overview

PORTS waste management activities include both indoor and outdoor facilities. Indoor facilities are protected by both hard-piped fire suppression systems and portable fire extinguisher systems. The facilities are also linked to the on-site fire department for emergency response. Types of fire prevention systems, inspection frequencies, and building characteristics for the hazardous waste storage facilities are outlined in Section “F” of the RCRA Part B Permit. Outdoor facilities do not have fire systems built into the facility. Fire prevention is performed by daily security inspections and employee notification to the on-site fire department. Types of fire prevention systems, inspection frequencies, and building characteristics for the all waste storage facilities are further outlined in the Safety Analysis Report (SAR) chapters 1, 3, and 4.

Hazardous waste storage facilities are contained with a six-inch concrete dike. The dike and floor are sealed with a chemical resistant coating. For higher assay wastes, a one inch dike is used with the same chemical resistant coating. A detailed discussion of the dike plan and sealants is outlined in Section “D” of the RCRA Part B Permit. Polychlorinated Biphenyl (PCB) storage areas are controlled in a similar manner. Liquid PCB waste storage areas are bounded by twelve-inch PVC pipe cut in half to provide a six-inch dike. The dike and floor are covered with a liner to prevent spills from entering the environment. Outdoor storage pads do not have a containment system. All outdoor pads are used to store containerized low level waste except for one which is used to store bulk scrap metal.

The PORTS waste management process is detailed in Section “D” of the RCRA Part B Permit. The management techniques are consistent for hazardous, PCB, and low level wastes. The PORTS aggressive, formal waste and facility inspection program is implemented through LMES/PO-WM-P1610, “Waste Storage Inspection Requirements.” An inspection of all waste

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storage and handling facilities is conducted on a weekly basis. The inspection focus is on container integrity (including bulging and leaking), compatibility, and RCRA permit criteria.

3.1.2 Waste Tracking

Waste tracking is performed by a threefold system. The first element is a standard form known as a Request for Disposal (RFD) form. The form is completed by generators of waste and appropriate waste management functional area personnel. Waste management (WM) personnel coordinate with generators to confirm the identity of the materials they will be receiving and prepare to receive the waste into inventory in a manner that meets all compliance-related requirements. Chemical compatibility assurance begins at the time the generator initially requests disposal. The RFD is the initial waste tracking mechanism. The second element is a computerized database, called Portsmouth Waste Tracking and Reporting System. The RFD forms are sequentially numbered; the current status of the waste represented on the forms is maintained in the computer database. A barcode system is used to link container locations to the computer database. The third element of the waste tracking system is the individual waste container. The container reflects particular information about the contents and is consistent with the RFD form and the database. Once a waste is found to meet the waste acceptance criteria for the receiving facility and is received into inventory, it is actively managed through daily inspections. Immediate corrective actions are taken for all off-normal conditions. Disposal of the waste material occurs only after the chemical composition is confirmed and an appropriate disposal outlet is available.

3.1.3 Waste Management Facility Practices

A tempered look at waste components must be made because the overall goal of waste management is to safely store waste. Waste descriptions that are provided by the generator and verified by the waste management organization identify the hazardous material that causes the waste to be regulated. However, the description does not take into account other activities that affect the waste such as dilution of original chemical concentration by use for the chemical's intended purpose or mixing with other compatible materials in the waste generating process. In other words, the waste descriptions, when taken as absolute, make the waste appear much more dangerous.

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Routine waste operations, at worst case scenario, may experience the following events:

Table 1
Potential Adverse Reactions of Waste in Storage

Condition	Potential	Control
Acidic waste ($\text{pH} \geq 2$) in steel drums.	0.01 molar hydrogen ion concentration in waste is above the amount needed to produce hazardous levels of hydrogen. Assuming 10% headspace, there is a potential for over-pressurization.	Visual inspections and verify pH level.
Corrosive waste ($\text{pH} < 2$) in steel drums.	Long-term storage may generate hydrogen pressure.	Visual inspections and verify pH level.
Sulfuric Acid at concentrations 0.02 - 12.00 normal	Standard waste container does not meet manufacturer's specifications.	Store in labeled non-reactive containers (glass or plastic) protected from heat and incompatible substances.
Hydrofluoric Acid solutions	Attacks coatings. Implication from Material Safety Data Sheet (MSDS) is that the acid could destroy drum coating and react with the metal.	Visual inspection.
Other acids stored in steel drum	Phenolic inner drum coating does not protect welds. Corrosion tends to make pin-holes and vent pressure.	Visual inspection.
Organics mixed with oxidizing acids	Oxidation and over-pressure.	Visual inspection.
Perchloric Acid in plastic drums. (rare)	Perchlorate formation could lead to explosion if container emptied and let to dry.	Visual inspection.
Cyanides mixed with acids.	Cyanide release during mixing of hydrogen cyanides (HCN) in headspace.	Cyanide levels are not at detectable levels. Oxidizing agents tend to destroy HCN over time. HCN is miscible and not likely to form hazardous concentrations in headspace unless very concentrated.

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A waste study was conducted in early July to determine potential compatibility problems. The study was conducted in accordance with EPA Publication 600/2-80-076, *A Method for Determining the Compatibility of Hazardous Wastes*. A reactivity group name (RGN) was assigned to each waste stream based on the waste streams active components. The RGNs were then compared to determine potential waste incompatibilities. The study determined that Portsmouth manages eight waste streams with potential incompatibilities resulting in fire, explosion, or the generation of poisonous gas. Portsmouth mitigates any potential for reaction by performing proper waste management techniques.

Two waste streams, waste chemicals and off-specification chemicals, are segregated by compatible waste code and then lab-packed. The lab-packed waste is further segregated by storage area and only compatible wastes are stored together. A third stream, compressed gas cylinders are small laboratory bench size cylinders that are protected from impact and stored with other compatible wastes. The fourth, batteries, are either recycled or stored with compatible wastes. Three other waste streams are related to the enrichment process. Those waste streams are oils that are contaminated with extremely low levels of heavy metals. A reaction at the heavy metal contamination level is extremely unlikely. The final waste stream, flourine sludge, is netralized by the waste generator to a pH level between 12 and 14. The only metal which comes in contact with the waste is copper; therefore, a chemical reaction is not likely.

Generally, waste streams that share a narrow description of EPA Identification Codes are stored together. The practice of the facility is to segregate material by waste code, not by waste stream. The segregation by waste code is outlined in operator aids, but not in a formal procedure. The segregation by code is followed up by visual inspections which are performed in accordance with a formal procedure. As a routine practice, PORTS Waste Operations does not overpack damaged/leaking containers with liquids, rather the contents are transferred to a new container prior to placement or return to storage. Revisions to include this practice as formal command media are in progress. Enclosed as Appendix A are the nine vulnerabilities descriptions concerning current waste streams at PORTS.

3.1.4 Pollution Prevention Program

The Pollution Prevention Program promotes and implements practices which reduce or eliminate the amount and toxicity of waste and pollutants in the air, water, and on land. One of the crucial activities of the Pollution Prevention Program involves improving operating practices, substituting less toxic or hazardous materials in process operations, and changing processes to produce less toxic products/wastes whenever possible. The Pollution Prevention Program also promote the use/substitution of nonhazardous materials for hazardous materials in operations to minimize potential risk to human health and the environment.

3.2 Hazardous Materials Management Program

3.2.1 System Overview

The PORTS hazardous materials management program is founded on a basic ES&H administrative strategy of applying (1) procedures and standards, (2) information management systems, and (3) highly qualified people, to safely and effectively carry out the challenging tasks at a hazardous materials worksite. As implemented, the program embodies the basic concepts of integrated safety management contained in DOE Policy 450.4, *Safety Management System Policy*. LMES has incorporated this policy into its basic ES&H program with Program Description MS-102PD, *Integrated Safety Management Program*. Additional command media which apply more directly to hazardous materials management include SH-132PD, *Hazardous Chemicals in Laboratories*, PORTS-SH-140PD, *Lockheed Martin Energy Systems Hazard Communication Program*, and PORTS-SH-161-PD, *Hazardous Waste Operations and Emergency Response (HAZWOPER)*.

3.2.2 Hazard Communication

The Energy Systems Hazard Communication Program Description, PORTS-SH-140PD, outlines the methods for communicating the potential hazards of chemicals used in the workplace to workers. These methods include employee training, container labeling, and use of Material Safety Data Sheets (MSDSs).

Awareness level hazard communication training is provided for all Energy Systems employees, service subcontractors, and visitors during General Employee Training (GET). Additional hazard communication training (Hazard Communication Level I) is provided based upon the potential for exposure to hazardous chemicals. Work area (job-specific) hazard communication training is provided by the responsible supervisor upon the employee's initial entry into the work area and whenever a new hazard is introduced into the work area. Labeling is used to identify hazardous chemicals and associated hazards.

Material Safety Data Sheets for hazardous chemicals used in work areas must be accessible to employees, service subcontractors, and visitors. The PORTS computerized MSDS provides detailed hazard information such as material compatibility data for chemicals purchased from the manufacturer and chemicals produced as byproducts or manufactured in the workplace. The responsible supervisor of each work area is required to develop a list of the hazardous chemicals used in the work area. This list and corresponding MSDSs shall be readily available to workers for review.

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3.3 Facility Safety Program

The mission of the PORTS Site Facility Safety Program is to provide a consolidated method for the identification and evaluation of hazards, control and minimization of analyzed hazards, and the communication of results to PORTS Site personnel. The primary function of Facility Safety is risk reduction. This is achieved by ensuring that activities have been appropriately evaluated for hazard potential. Activities with unacceptable risks are prohibited. For activities with inherent hazards, measures must be devised to ensure that the hazards are controlled and do not pose an unacceptable risk to personnel or the environment.

3.3.1 Program Components/Elements

Documents which are created for facilities, activities, and processes after completion of analyses and development of mitigators and controls are called Authorization Basis Documents (ABDs). These documents describe important concepts needed for the safe operation of facilities. Development and issuance of these documents establish the operational boundaries or “envelope” which must be maintained by the facility operator and personnel in order to have continued safe operations and compliance with regulatory requirements.

The Site Facility Safety Program applies to all activities, operations, or processes which can adversely impact the health and safety of on-site or off-site personnel, as well as the environment. These activities are typically associated with the use of toxic, reactive, or radiological materials or materials with unfavorable physical properties (flammable, explosive, asphyxiants). Additional activities, operations, and processes which fall under the Site Facility Safety Program are those with unusual or hazardous energy sources or equipment not typically controlled by general industry standards requirements.

3.3.2 Requirements

Facility Safety guidance and direction is obtained from numerous sources. Governmental regulations, Lockheed Martin Corporate, Lockheed Martin Energy Systems, Inc., and PORTS Site-specific policies, program documents and procedures establish the requirements and guidelines for the site’s Facility Safety program. The primary Energy Systems documents which present the scope, purpose, and operation of Facility Safety Programs are FS-101PD “Facility Safety Program,” FS-102 “Unreviewed Safety Question Determinations,” and FS-103PD “Safety Documentation.”

FS-101PD “Facility Safety Program”

This program description presents the fundamental elements of the Energy Systems Facility Safety Program. Responsibilities of key personnel and organizations are delineated. These include the Director of Nuclear Safety, Business Unit Managers, Line Managers, Central Engineering Services, Evaluations and Quality organizations, the Installation Facility Safety Manager (IFSM), Independent Review Committees, and the general plant population. Key terms applied in Facility Safety are defined in this document.

FS-102 “Unreviewed Safety Question Determinations”

Once the operational boundaries and requirements are established by the ABDs, the facility, operation, or process should be maintained and operated within those boundaries and requirements. Any changes to the facility, operation, or process must be evaluated to ensure that the change cannot introduce a new hazard or increase the consequences or likelihood of previously identified hazard. Conditions or properties of the facility, operation, or process which have not been identified and analyzed are called “as-found conditions” or “as-found properties.” These “as-found” conditions or properties must be analyzed to determine their impacts on the safety of the facility, operation, or process.

FS-102 establishes the requirements and methods for evaluating changes to facilities and “as-found” conditions in facilities which have been identified as “Nuclear Facilities” or “Hazardous Facilities.”. FS-102 provides a systematic method for evaluating new proposed activities, processes, or situations to decide if the current authorization basis will remain valid or if DOE approval is required before making the change.

FS-103PD “Safety Documentation”

This program description identifies the safety documentation requirements for compliance with DOE Orders 5481.1B, 5480.21, 5480.22, 5480.23, and OSHA Standard 29 CFR 1910.119. This procedure provides a description of the various types of safety documentation and brief guidance on what types of facilities, operations, or activities require safety documentation.

For activities subject to the PORTS Authorization Basis Document (ABD), configuration control will be maintained to ensure activities remain within the approved document. Management of changes will be per DOE Order 5480.21, *Unreviewed Safety Questions*, and FS-102, *Unreviewed Safety Question Determinations*.

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3.4 NEPA Reviews

The National Environmental Policy Act (NEPA) provides a means to evaluate the potential environmental impact of proposed federal activities and to examine alternatives to those actions to ensure informed decision-making. LMES Procedure No. ESP-EP-163 entitled *National Environmental Policy Act Review and Compliance* establishes administrative controls and provides requirements for project reviews and compliance with NEPA. Each proposed action and all components of the action are reviewed for its potential to result in significant impacts to the environment; and based on technical information supplied by the responsible organization, an appropriate level of NEPA documentation is prepared. NEPA reviews are conducted early in the planning cycle to provide input into the decision-making process, thus allowing time for changes prior to construction or prior to proceeding with process implementation.

3.5 Surveillance and Maintenance Program

On May 22, 1995, DOE and the U.S. Environmental Protection Agency (EPA) agreed to the *Policy on Decommissioning of Department of Energy Facilities under CERCLA*. This policy established the decommissioning of DOE facilities under the regulatory authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) with implementation under the Federal Facility Agreement (FFA).

All FFA projects, including remedial actions, Surveillance and Maintenance, and Decontamination and Decommissioning (D&D), pass through a risk-based prioritization system that includes regulatory and public involvement to rank projects. The current year milestones are then reviewed to reflect current year funding levels. The project rankings and available funding determine which projects are funded with particular emphasis on keeping active projects brought to completion prior to starting new projects.

3.6 Waste Storage Tank Vulnerability Assessment

On October 21, 1997, the Secretary of Energy requested all sites perform an assessment of hazards associated with chemical and radiological waste storage tanks and ancillary equipment. The scope of this effort includes storage tanks, which are defined as enclosed vessels with in/out process lines and having greater than 100 gallon capacity. This specifically excludes sumps, pits, trenches, water holes, cylinders, converters, compressed gas and liquid nitrogen containers, atmospheric containers with open tops, and basins. In evaluating the waste storage tanks at PORTS, it was verified that there were no tanks which met the above vulnerability assessment criteria.

4. KNOWN VULNERABILITY ASSESSMENTS

This chapter responds to the record initiative addressed in the August 4, 1997, directive from Secretary Frederico Peña that reads as follows:

DOE field offices must reassess known vulnerabilities (chemical and radiological) at facilities that have been shut down, are in standby, are being deactivated, or have otherwise changed their conventional mode of operation in the last several years. Facility operators must evaluate their facilities and operations for new vulnerabilities on a continuing basis.

Since 1993, DOE has conducted a series of assessments across the complex to identify ES&H vulnerabilities associated with chemicals, spent nuclear fuel, and weapons usable fissile materials (plutonium and uranium). PORTS was not included in the scope of the Spent Fuel and Plutonium Vulnerability Assessments because of the absence of these materials at the site. ES&H vulnerabilities were identified in the HEU Vulnerability Assessment, but they were determined to present no imminent danger to workers, the public, or the environment.

4.1 Portsmouth HEU Vulnerability Assessment

Approximately 22 metric tons of HEU in various physical and chemical forms, mainly solids, reside at Portsmouth. Significant quantities of HEU also reside as holdup or deposits inside process equipment no longer used for processing. Some 3,148 individual items were covered in this assessment. Over 98 percent of the Portsmouth inventory is in Building X-345 in the forms of uranium hexafluoride, oxides, process residues, and holdup. A 15-member Working Group Assessment Team (WGAT) and an 8-member Supervisory Assessment Team conducted the PORTS HEU vulnerability assessment. Stakeholder representatives attended the public meeting and were given the opportunity to comment on all assessment results.

4.1.1 Summary of Vulnerabilities and Corrective Actions

A total of 16 PORTS HEU vulnerabilities were identified and reported in July 1996: 11 facility condition, 4 material/packaging, and 1 institutional. The most significant vulnerabilities, in order of decreasing priority are:

- Spread of contamination due to rainwater in leakage.
- Breaching, from mishandling, of metal canisters of uranyl fluoride absorbed on alumina trap material that have been degraded by corrosion due to moisture and hydrogen fluoride.
- Breaching from mishandling, of unsealed metal canisters of HEU oxide.
- Spread of contamination from fire and activation of the fire suppression system for Building X-744-G.

Known Vulnerability Assessments

- On-site transportation accident involving canisters carried in the bed of a pickup truck.

4.1.2 Specific Corrective Actions

Contamination:

Gaps in doorways, roll-up doors, and walls in Building X-744-G could allow rainwater to enter. Water could spread existing HEU contamination, resulting in worker exposure and releases to the environment. The spread of HEU contamination in the X-705E area due to rain or surface water in leakage is possible due to gaps around doorways and roll-up doors. In leakage could spread existing contamination to other areas inside or outside the facility. **Corrective action taken:** Door seals have been inspected and repaired. General clean-up was completed.

Fire vulnerability:

Building X-744-G is the interim storage site for spent alumina trap material, some of which contains HEU. This building was determined to represent possible HEU contamination due to fire. **Corrective action taken:** Although fire loading was within the fire suppression design limits, the majority of fire loading has been removed from the facility.

Transportation accidents:

Alumina trap material with absorbed uranyl fluoride is shipped locally in the bed of a modified pickup truck. Vehicular accidents could damage the canisters holding the trap material and spread contamination on-site. **Corrective action taken:** Completed inspection and adjustment of all restraints. Ongoing safe transportation and handling measures in place.

Material/Packaging vulnerabilities:

Metal canisters containing uranyl fluoride absorbed on alumina trap material in Building X-744-G and X-345 are susceptible to corrosion. Corrosion results from the in leakage of moisture and the internal generation of hydrogen fluoride gas from trace amounts of uranium hexafluoride reacting with water of hydration contained with the alumina. Hydrogen fluoride also embrittles plastic inner liners. Dropping a container could lead to a breach of packaging, resulting in the spread of contamination to workers and the buildings. In building X-345, some metal HEU oxide storage containers have been opened and not resealed with a new lid. Material could be released if the can were dropped and plastic bags enclosing the canister and inner liner damaged. **Corrective action taken:** All HEU alumina containers are inspected when first handled out of the storage arrays. Repackaging occurs only when those HEU alumina containers have been previously opened and therefore do not meet Department of Transportation (DOT) requirements. All HEU alumina containers are then overpacked in protective shipping containers and shipped to a vendor for the purpose of extracting the HEU from the alumina. This action started in October 1997 and will be completed in February 1998.

4.2 Safety Analysis Report

4.2.1 Overview

The SAR for PORTS was approved and transmitted to DOE, USEC, and NRC on February 13, 1997. This is one of the first SARs prepared in accordance with DOE Order 5480.23 and DOE STD 3009-94 and is thought to be the first approved site-wide SAR. The SAR was designed to support the USEC certification process by NRC and to support DOE's continuing operations at the site. An implementation plan that identifies action items, costs, and schedules necessary to become compliant with the DOE-approved SAR was also prepared and issued.

4.2.2 Summary of Hazard Analysis and Evaluation

The SAR for PORTS presents hazard analysis that provides a thorough, predominantly qualitative evaluation of the spectrum of risks to the public, workers, and the environment resulting from potential accidents involving the identified hazards. The results of the hazard analysis include the identification of safety-significant structures, systems, and components (SSC's) and a reasonable spectrum of initiating events for evaluation in the accident analysis.

The hazard and accident analysis uses a graded approach to determine the level of analysis applied to each identified hazard. This approach requires that the level of analysis and documentation for each facility be commensurate with

- the magnitude of the hazards being addressed,
- the stage or stages of the facility life cycle for which DOE approval is sought, and
- the complexity of the facility and/or systems being relied on to maintain an acceptable level of risk.

The hazard and accident analysis was performed using a graded approach. If a hazard poses a more significant threat for the facility (i.e., health consequences), a more detailed analysis was performed, which results in more stringent safety controls being imposed. Note that standard industrial hazards for which national consensus codes and/or standards (e.g., OSHA) exist are not in the scope of this SAR except where these hazards are identified as initiators or contributors to accidents in the facility.

Known Vulnerability Assessments

Grading was also applied at each step of the analysis process. The analysis process requires the following four major steps:

- hazard identification and screening;
- hazard classification;
- hazard analysis, and
- accident analysis and development of safety controls.

Hazard identification and screening was used to review the facility hazards to determine further safety analysis was required. This was accomplished by comparing the hazards with a screening value. If the identified hazards remained below the screening values, the results were documented and no additional analysis was required for the facility. The second step of the process involved classifying the facility in accordance with DOE-STD-1027-92 (DOE 1992). The third step required analysis of the hazards associated with the facility. The final step of the overall process involved taking the most significant hazards within the facility, determining specific accident scenarios, identifying safety controls that can minimize the frequency of the event occurring, and identifying safety controls that can be used to mitigate the event, should it occur.

Hazard analysis is the process of identifying facility hazards and evaluating potential initiating events, consequences that may result from accidents involving these hazards, and controls that may be used to prevent or mitigate the consequences. The hazard analysis is divided into two parts—hazard identification and hazard evaluation.

Hazard identification selected those facilities that possess nonstandard industrial hazards that may present a threat to the health and safety of on-site workers or the general public. Hazard identification and controls associated with routine industrial hazards is provided by systems described in Section 2.2. Hazard identification also determined which hazards require more detailed analysis based on the consequence screening criteria. Hazards that are not “screened out” in this process are subject to hazard evaluation.

Hazard evaluation is the process of identifying initiating events that can lead to accidents involving the hazards screened previously, qualitatively determining the consequences of such accidents, estimating the initiating event frequencies, comparing the consequences to threshold values, and identifying the controls needed to prevent such accidents or mitigate their consequences. Results from hazard analysis and evaluation were utilized to establish controls: administrative and equipment required to protect the worker, public, and environment.

Hazard evaluation qualitatively determined the unmitigated consequences of potential accidents involving a given hazard, the initiating events for the accident, the frequency of the initiating events, and controls that may be used to prevent or mitigate the initiating events. The

unmitigated consequences were compared with threshold consequence values to determine if more detailed accident analysis may be required. The hazard analysis (1) documented the hazards of concern, (2) determined the initiating events and consequences, (3) identified controls to minimize potential consequences, (4) identified limiting initiating events that require more detailed analysis, and (5) selected controls that were determined to be safety-significant based on their importance in the event scenario for protecting the on-site workers.

4.3 Facility Assessments

4.3.1 Process Safety Management

On January 27, 1997, LMES reported a reassessment of inventories covering highly hazardous chemicals (HHCs) and flammable materials relative to the Occupational Safety and Health Administration Process Safety Management rule, 29CFR 1910.119, and the recently issued Environmental Protection Agency Risk Management Plan (RMP) rule, 40 CFR 68. This survey included the non-leased operations at the Portsmouth Site.

The results concluded that inventory databases are maintained at the sites to allow evaluation of chemical and hazardous waste inventories against regulatory thresholds and safety authorization requirements. Also, configuration management guidelines at the sites require safety evaluations if changes are made to facilities or operations with hazardous materials. Changes to facilities typically involve modifications to inventory levels, additions of new hazards or hazardous materials, or changes to operations or processes.

4.3.2 Chemical Explosion at Hanford

Since the May 14, 1997 chemical explosion at Hanford and the subsequent September 18, 1997 waste drum incident at Paducah, Portsmouth has been actively investigating all possibilities of chemical incompatibilities. This investigation has included a review for potential degradation or concentration of chemical, a re-inventory of storage containers and storage facilities, including a detailed vulnerability review to ensure a thorough understanding of each hazard.

On June 25, 1997, Portsmouth responded to the May 28, 1997 Red Alert R-1997-OR-LMESCENT-0501, Chemical Explosion at Hanford. This response included a detailed review of the following areas:

- Corrosion product catalyzed reactions,
- Slow chemical degradation,
- Concentration by evaporation, and
- Inadvertent cross contamination or co-mingling of incompatible materials.

Known Vulnerability Assessments

4.3.3 TOMSK-7 Assessment

4.3.3.1 Background

On April 6, 1993, a sequence of events occurred at the Siberian Chemical Combine at TOMSK-7 in Russia that caused substantial physical damage to the facility. A runaway exothermic chemical reaction occurred in a large process vessel that contained a concentrated solution of uranyl nitrate, nitric acid, plutonium nitrate, residual fission products, and an undetermined amount of organic constituents derived from the solvent extraction process. This reaction produced a copious amount of flammable organic and inorganic gases and steam, which pressurized and burst the vessel, dislodged the concrete cell cover, and, it is believed, ignited in the area immediately above the cell.

4.3.3.2 Action

In response to early reports of the incident, the U.S. DOE sent a team of experts to TOMSK-7 to learn the details of the incident and subsequently initiated a series of reviews at DOE sites to assure that similar conditions do not exist in DOE processing vessels. In a February 23, 1994, letter to DOE Site Office managers, the DOE Oak Ridge Operations Office (DOE-ORO) Director of Safety and Health directed that a series of self-assessments were to be conducted based upon lessons learned from the TOMSK-7 incident. On May 11, 1994, PORTS reported the evaluation of applicability and a completed assessment of potential safety hazards associated with nitrate/organic reactions at the site.

4.3.4 Recent Assessments and Programmatic Reviews

During 1995, the DOE Office of Oversight reviewed the Environmental, Safety and Health, and Quality (ESH&Q) management programs at PORTS. The focus of this review was a management evaluation of all ESH&Q programs in which no new vulnerabilities were identified. All of the opportunities for improvements and their associated corrective action plans have since been completed and closed out. An independent validation of all chemical incompatibility possibilities was conducted by the PORTS Safety and Health Division concerning the evaluation of existing wastes stored in the X-7725 facility following the ruptured drum incident at Paducah.

4.4 PORTS Site-Wide Assessments

Radiological Control Surveys and Assessments

Radioactive contamination surveys are performed in certain areas on a routine basis, and in other areas as requested to support projects and work activities. Surveys are also performed if radioactive contamination is suspected to be present in areas where contamination was not

previously known to be present. Radiological Control (RadCon) surveys are limited to radioactive contamination and materials, and to a lesser extent, radiation. Self-assessments are performed on a daily, weekly, and quarterly basis as prescribed by procedure RCO-AD-400. Results are documented on Radiological Awareness reports and Radiological Deficiency reports.

Annual LMES Integrated Audits

LMES performs annual integrated audits, which consist of subteams addressing management and quality, safety and health, and environmental protection issues. The audit subteams are made up of subject matter experts from other LMES sites and central staff who perform an in-depth review of processes and field conditions with an emphasis on safety, health, and environmental protection. Audit findings, including those that identify vulnerabilities, are addressed in the issues management system and tracked until corrected.

Corporate Environment, Safety, Health, and Quality Assurance (ESH&QA) Audits

Every three years, a Lockheed Martin Corporation ESH & QA audit is performed by a team of subject matter experts from other sites across the country. It is anticipated that the M&I contractor will perform similar audits. The emphasis of these audits is on safety, health, and environmental protection in the work place and compliance with related regulations and orders. Audit findings, including those that identify vulnerabilities, are addressed in corrective action plans approved by senior Lockheed Martin management. The findings are also placed in the issues management system and tracked until corrected.

Internal Independent Audits

A series of audits of site activities, including those related to vulnerability identification and correction are performed each year by the PORTS Performance Assurance Division; independent of the management self assessments. The audits are performed by trained auditors, using checklists based on regulations and requirements. As with other audits, the findings are placed in the issues management system and tracked until corrected

Facility Excellence Walkdowns

The Facility Excellence Program involves weekly walkdowns of selected facilities to assess environment, safety, and health concerns as well as general facility conditions. Walkdown teams include senior and line management, facility operations managers. The facilities are rated on a scale by the walkdown teams. The program promotes continued awareness of facility conditions by building operators and occupants. Any concerns regarding hazardous/radioactive materials and wastes are identified by the walkdown teams as part of the overall ES&H assessments.

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PORTS Self-Assessment

Portsmouth has implemented an effective, ongoing self-assessment program that ensures participation by their employees as well as all levels of management within their organization. The self-assessment process is the upper tier process for which all other processes for identifying vulnerabilities is an integral part. The chemical and radiological hazards associated with the operation or facility are well known to the line/facility manager and form the basis for the operating procedures and safety authorization basis documents. Line and facility management are the logical point for the planning and implementation of effective self-assessment programs, since they manage the operation/facility and have the technical expertise to recognize potential vulnerabilities.

Emergency Planning Exercises

PORTS participates in an annual Full Participation Exercise and performs self-assessments during routinely scheduled site-wide drills. Each drill and exercise is subjected to an activity critique for vulnerabilities and areas for improvement. The results of exercises and drills are documented in exercise reports.

Price-Anderson Amendments Act Noncompliance Reporting Process

A strong historical site self-reporting philosophy and culture has been effectively integrated into the Price-Anderson Amendments Act (PAAA) Noncompliance Reporting Process. The process is directed toward Category 2 and 3 site activities (PORTS has no Category 1 facilities) and radiological facilities. The PORTS PAAA Process is described in NS-120, *PAAA Noncompliance Determination Process*.

Critiques of Events

Reported unusual events are evaluated using a structured critique process led by a trained facilitator. The process is designed to gather facts concerning the event and determine the cause or causes including the identification of any vulnerabilities that may be present and contributed to the event.

Problem Identification

Portsmouth has implemented a program to facilitate individual problem identification of suspected problems. This process includes feedback and resolves issues before major problems occur.

Issues Management Process

Issues management begins with the recognition and identification of an issue and ends with a permanent solution to the identified issue. “Issue” is a generic term for problems, deficiencies, findings, concerns, alerts, recommendations, observations, and other conditions requiring evaluation for corrective action. The issues management system is a process for collecting feedback and improving work performance and safety. This system contains the following components:

- Collect work performance data from internal and external sources
- Identify immediate mitigating actions
- Screen data to identify issues that present opportunities for improvement
- Determine the risks and benefits of resolving the issues
- Develop action plans to complete long-term improvements

Energy Systems Action Management System

Energy Systems Action Management System (ESAMS) is a computer-based program that assures action commitment attention by tracking completion dates, issuing automatic reminders, and reporting to management on delinquent action completions. Issue actions required to be entered into the system come from audits, evaluations, as-found conditions, reviews and deficiency reporting activities. Other proactive processes, such as the USQD Program and event critiques, may also require actions, which are then entered into the issues management database. Over 200 issues and corrective actions were opened in the Issues Management System in fiscal year 1997. This demonstrates that problems and deficiencies are being found.

Occurrence Report Investigations

Occurrence notifications identified during facility operation come from incidents that occur during a planned activity, as-found activities that place the facility outside of the safety authorization basis, and conditions detected during normal site surveillance and maintenance activity. The dispositioning of occurrence notification events requires the development of corrective actions, an evaluation for root cause, and reviews for lessons learned and generic implications. These assessments go well beyond the existing condition and look at the extent of the vulnerability across the facility, site, and Oak Ridge Reservation.

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Lessons Learned Review and Dissemination Process

The Lessons Learned Program is a process by which successes, problems, and uncommon experiences are recorded for the future and are communicated across the company and the DOE Complex. The information disseminated comes from experiences of employees, DOE and other DOE contractors, and other government agencies and companies. This ensures a systematic and timely process of notifying various operating units if an experience is detected that could have significant adverse effects on quality, safety, the environment, or health. These reports often relate newly discovered vulnerabilities.

4.5 DNFSB Recommendations

4.5.1 Recommendation 94-1 (Deposit Removal Program)

The DNFSB issued Recommendation 94-1 on May 26, 1994. DOE accepted the DNFSB's recommendation on August 31, 1994. The DNFSB noted in Recommendation 94-1, that it was concerned that the halt in production of materials to be used in nuclear weapons froze the manufacturing pipeline in a state that, for safety reasons, would not be allowed to persist unremediated. In its implementation plan dated February 28, 1995, DOE broadened the scope of the response to Recommendation 94-1 to include additional bulk liquids and solids containing fissile materials and other radioactive substances in spent fuel storage pools, reactor basins, reprocessing canyons, processing lines, and various facilities that require conversion to forms, or establishing conditions, suitable for safe interim storage. The scope was broadened to ensure that similar materials under similar conditions receive the same degree of management attention as those noted by the DNFSB in its recommendation.

4.5.2 Recommendation 95-1 (Uf₆ Cylinders)

In response to Secretary Peña's request to review safety management system principles and functions, the UF₆ Cylinder Project reassessed both the DOE Chemical Vulnerability Assessment of 1994 and the DNFSB Recommendation 95-1, which detailed poor maintenance and storage conditions of depleted uranium hexafluoride (DUF₆).

On the basis of the issues identified in these two reports, the following three recommendations regarding the storage of DUF₆ inventory were issued.

- Start an early program to renew the protective coating of cylinders,
- Explore the possibility of additional measures to protect cylinders from exposure to elements, and
- Institute a study to determine whether a more suitable chemical form should be selected for long-term storage.

To facilitate safe and integrated management of the DUF₆ inventory, a systems engineering approach was initiated. This approach focuses on defining the risks, identifying system requirements, and implementing actions through a series of seven documents and implementing procedures. The seven documents are Systems Requirements Document, System Engineering Management Plan, Program Management Plan, Engineering Development Plan, and site-specific SARs. To date, all seven documents have been developed and approved and are being used to successfully control the numerous activities that enable the safe storage of the DUF₆ inventory at Portsmouth until ultimate disposition.

Reassessment of the commitments associated with this vulnerability reveals that all deliverables have been completed on time and that they have been approved. Additionally, it was determined that all remaining open activities are progressing as planned. The overall conclusion of this review is that potential consequences of previously identified vulnerabilities are judged to be negligible. Thus, the UF₆ Cylinder Project will continue its mission to safely store the DUF₆ inventory until ultimate disposition.

In an April 16, 1997 letter, Mark B. Whitaker, Jr. Departmental Representative to DNFSB, observed that the implementation plan for addressing DNFSB recommendation 95-1 established a number of milestones to be completed over an 18-month period. Mr. Whitaker observed that this “is the first instance since the Board’s inception that the Department has completed each and every implementation plan deliverable on time as committed. You and your team are commended for your excellent focus and performance. You have set a standard of excellence for all to follow.” The implementation plan involved development of a system engineering approach and extensive field work. Visible improvements in the field have included improved storage of cylinders and more rigor and formality in daily operations.

4.6 Process for Evaluating New Vulnerabilities

The systems used at PORTS to identify and evaluate new vulnerabilities on an ongoing basis are consistent with the functions of integrated safety management system (ISMS). The overall site program for ISMS is described in Section 2.0. An important part of the site’s ISMS program involves adequate work planning which is particularly applicable to the ISMS functions of

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defining work scope, analyzing hazards, identifying work controls, and performing work in accordance with the controls. Vulnerabilities are identified during the working planning phases of projects and activities. Applicable ISMS functions for these programs and practices include analyzing the hazards, identifying work controls and performing work in accordance with the controls. The remaining ISMS function, feedback and continuous improvement, is achieved through a variety of site programs and systems discussed above with this section.

Appendix A
VULNERABILITY DESCRIPTIONS FOR CURRENT WASTE STREAMS AT PORTS

Appendix A

SITE / FACILITY: PORTS / X-326 L Cage and X-7725 Waste Storage Unit

VULNERABILITY NUMBER: 1

1. BRIEF DESCRIPTION OF VULNERABILITY

Potential incompatibilities of containers placed into long-term storage for waste stream SW-1, *Laboratory Off-specification Chemicals*.

2. SUMMARY OF VULNERABILITY

The waste stream is one that is generated on a site-wide basis; therefore, control over a single generator is not feasible. The waste stream is comprised of small laboratory (generally one-gallon in size or less) containers of unused material that is either manufactured off-specification or the shelf life has expired. The waste stream is made up of mineral and organic based acids, alcohols, aldehydes, amines, various compounds, carbamides, cyanides, epoxides, esters, ethers, fluorides, hydrocarbons, halogenated organics, isocyanides, ketones, metals (elemental earth), metals (powders and sponges), metals (sheet, compounds, and alloys), organic compounds, organic peroxides, organic sulfides, organophosphates, phenols, shock sensitives, sulfides, polymaleable compounds, oxidizing agents, reducing agents, and water reactive substances.

3. BASIS

a. Reference

EPA Publication 600/2-80-076, *A Method for Determining Compatibility of Hazardous Wastes*.

PORTS' Resource Conservation and Recovery Act Part B Permit.

b. Potential Consequences

If incompatible wastes would come into contact with each other, heat generation, fire, toxic gas generation, flammable gas generation, explosion, violent polymerization, or solubilization of toxic substances may occur.

SITE / FACILITY: PORTS / X-326 L Cage and X-7725 Waste Storage Unit

VULNERABILITY NUMBER: 1

c. Mitigating Practices

In calendar year 1996, all waste containers that were used to store small laboratory off-specification chemical containers were repackaged into proper lab-packs. The process of re-packing included vigorous inspection of the small chemical containers for integrity and radioactive contamination. Small containers of off-specification chemicals were then compared to each other and placed into lab-packs with other compatible chemicals. After a lab-pack was filled with all of the small off-specification chemical containers that would go into that lab-pack, the void space was filled with vermiculite. Further segregation is achieved by only storing containers of compatible wastes in the same storage area.

The X-326 L Cage and the X-7725 Waste Storage Unit are facilities that are made of a series of storage areas. The areas are contained by a dike in order to contain hazardous wastes in the event of a container breach. Only compatible containers of waste are placed in the same storage area.

A detailed log for each new lab-pack of its contents was completed. The log includes the name of each chemical placed into a certain lab-pack, the volume of each small container, type of each small container, the EPA identification for each small container, and the previous waste container the small chemical container came from.

Since the completion of the re-packing project, non-laboratory off-specification chemicals are packed under strict scrutiny of a trained waste management representative. The generator consults with the representative prior to packing and during the packing process. All compatibility issues are addressed during this time.

All waste containers, including lab-packs, are inspected weekly. Any container deficiencies are immediately acted on to mitigate potential hazards and all corrective actions are completed within twenty-four hours after discovery. No liquid wastes are over-packed; rather, liquid waste containers, if a deficiency is identified, are repackaged.

Appendix A

SITE / FACILITY: PORTS / X-326 L Cage and X-7725 Waste Storage Unit

VULNERABILITY NUMBER: 2

1. BRIEF DESCRIPTION OF VULNERABILITY

Potential incompatibilities of containers placed into long-term storage for waste stream SW-11, *Non-laboratory Off-specification Chemicals*.

2. SUMMARY OF VULNERABILITY

This vulnerability is similar to the SW-1, *Laboratory Off-specification Chemical* vulnerability. The waste stream is one that is generated on a site-wide basis; therefore, control over a single generator is not feasible. The waste stream is comprised of small (generally one-gallon is size or less) containers of unused material that is either manufactured off-specification or has expired its shelf life. The waste stream is made up of mineral and organic based acids, amines, various compounds, cyanides, epoxides, esters, fluorides, hydrocarbons, halogenated organics, ketones, metals (elemental earth), metals (powders and sponges), metals (sheet, compounds, and alloys), organic compounds, phenols, sulfides, polymaleable compounds, oxidizing agents, and water reactive substances.

3. BASIS

a. Reference

EPA Publication 600/2-80-076, *A Method for Determining Compatibility of Hazardous Wastes*.

PORTS' Resource Conservation and Recovery Act Part B Permit

b. Potential Consequences

If incompatible wastes would come into contact with each other, heat generation, fire, toxic gas generation, flammable gas generation, explosion, violent polymerization, or solubilization of toxic substances may occur.

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VULNERABILITY NUMBER: 2

c. Mitigating Practices

In calendar year 1996, all waste containers that were used to store small non-laboratory off-specification chemical containers were repackaged into proper lab-packs. The process of re-packing included vigorous inspection of the small chemical containers for integrity and radioactive contamination. Small containers of off-specification chemicals were then compared to each other and placed into lab-packs with other compatible chemicals. After a lab-pack was filled with all of the small off-specification chemical containers that would go into that lab-pack, the void space was filled with vermiculite. Further segregation is achieved by only storing containers of compatible wastes in the same storage area.

The X-326 L Cage and the X-7725 Waste Storage Unit are facilities that are made of a series of storage areas. The areas are demarcated by a dike in order to contain hazardous wastes in the event of a container breach. Only compatible containers of waste are stored in the same storage area.

A detailed log for each new lab-pack of its contents was completed. The log includes the name of each chemical placed into a certain lab-pack, the volume of each small container, type of each small container, the EPA identification for each small container, and the previous waste container the small chemical container came from.

Since the completion of the re-packing project, non-laboratory off-specification chemicals are packed under strict scrutiny of a trained waste management representative. The generator consults with the representative prior to packing and during the packing process. All compatibility issues are addressed during this time.

All waste containers, including lab-packs, are inspected weekly. Any container deficiencies are immediately acted on to mitigate potential hazards and all corrective actions are completed within twenty-four hours after discovery. No liquid wastes are over-packed; rather, liquid waste containers, if a deficiency is identified, are repackaged.

Appendix A

SITE / FACILITY: PORTS / X-326 L Cage and X-7725 Waste Storage Unit

VULNERABILITY NUMBER: 3

1. BRIEF DESCRIPTION OF VULNERABILITY

Potential incompatibilities of containers placed into long-term storage for waste stream SW-4, *Mixed Batteries*.

2. SUMMARY OF VULNERABILITY

The waste stream is one that is generated on a site-wide basis; therefore, control over a single generator is not feasible. The waste stream is comprised of industrial-use batteries that are very similar to automotive batteries. The waste stream is comprised of the batteries left intact and stored on wood pallets. The internal components of the batteries are not altered and include mineral acids, metals, and water

3. BASIS

a. Reference

EPA Publication 600/2-80-076, *A Method for Determining Compatibility of Hazardous Wastes*.

PORTS' Resource Conservation and Recovery Act Part B Permit

b. Potential Consequences

If incompatible wastes would come into contact with each other, then heat generation, fire, flammable gas generation or solubilization of toxic substances may occur.

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VULNERABILITY NUMBER: 3

c. Mitigating Practices

In fiscal year 1997, the pollution prevention shipped over 90% of the batteries to a reclaiming facility in Wisconsin. Remaining batteries are stored in the X-7725 Waste Storage Unit on industrial size shelving constructed to hold filled pallets. The area that the batteries are stored is surrounded by a six inch dike to prevent contact with incompatible material.

The remaining waste containers are stored in an area surrounded by a six-inch dike. Each storage area is inspected on a weekly basis to ensure container and facility integrity. In the event that a container is found to be leaking, immediate corrective action is performed and final corrective action is completed within twenty-four hours. No liquid wastes are overpacked. If a liquid waste container requires repair, then the container contents is transferred to a new container.

Appendix A

SITE / FACILITY: PORTS / X-326 L Cage and X-7725 Waste Storage Unit

VULNERABILITY NUMBER: 4

1. BRIEF DESCRIPTION OF VULNERABILITY

Potential incompatibilities of containers placed into long-term storage for waste stream SW-7, *Gas Cylinders*.

2. SUMMARY OF VULNERABILITY

Small gas cylinders of hydrogen cyanide were used for instrument calibration in the on-site laboratory. The hydrogen cyanide gas cylinders were used to calibrate the laboratory instruments. The hydrogen cyanide cylinders were replaced with non-hydrogen cyanide cylinders. As a result, the spent hydrogen cyanide cylinders became hazardous waste. The internal cyanide residue includes acid, cyanide, and fluoride components.

3. BASIS

a. Reference

EPA Publication 600/2-80-076, *A Method for Determining Compatibility of Hazardous Wastes*.

PORTS' Resource Conservation and Recovery Act Part B Permit

b. Potential Consequences

If incompatible wastes would come into contact with each other, then toxic or flammable gas generation may occur.

SITE / FACILITY: PORTS / X-326 L Cage and X-7725 Waste Storage Unit

VULNERABILITY NUMBER: 4

c. Mitigating Practices

This waste stream was comprised of two bench-size compressed gas cylinders. One of the cylinders was shipped to a reclaimer. The other cylinder is spent; therefore, the cylinder is managed as hazardous due to the residue inside the cylinder. The single cylinder is segregated from incompatible waste by being placed in a storage area surrounded by a six-inch dike.

The waste containers are stored in an area surrounded by a six-inch dike. Each storage area is inspected on a weekly basis to ensure container and facility integrity. In the event that a container is found to be leaking, immediate corrective action is performed and final corrective action is completed within twenty-four hours. No liquid wastes are overpacked. If a liquid waste container requires repair, then the container contents is transferred to a new container.

Appendix A

SITE / FACILITY: PORTS / X-326 L Cage and X-7725 Waste Storage Unit

VULNERABILITY NUMBER: 5

1. BRIEF DESCRIPTION OF VULNERABILITY

Potential incompatibilities of containers placed into long-term storage for waste stream Cascade-2, *Solvent*, 720-8, *Waste Oil / Solvents*, and 342-2, *Generator Solutions*.

2. SUMMARY OF VULNERABILITY

Maintenance work in the process buildings results in the generation of waste solvents, oils, and solutions. The solvents, oils, and solutions may be contaminated with very small amounts of heavy metals. The solvents, oils, and solutions are not mixed with metals; rather, maintenance processes result in some heavy metal contamination.

The spent solvents may exhibit very low levels of aromatic hydrocarbon, halogenated organics, and metals. The spent oil/solvents may exhibit very low levels of halogenated organics and metals.

The generator solutions may exhibit low levels of acids and fluorides. The generator solutions are actually neutralized hydrofluoric acid slurry with a pH between 12.0 and 14.0. The only metal that comes in contact with the slurry is copper; therefore, a reaction is extremely unlikely.

3. BASIS

a. Reference

EPA Publication 600/2-80-076, *A Method for Determining Compatibility of Hazardous Wastes*.

PORTS' Resource Conservation and Recovery Act Part B Permit

b. Potential Consequences

For the spent solvents, If incompatible wastes would come into contact with each other, then heat or explosion may occur; for the spent oil/solvent, if incompatible wastes would come in contact with each other, then heat, fire, or explosion may occur; and for generator solutions, if incompatible wastes would come in contact with each other, then toxic gas generation or solubilization of toxic substances.

SITE / FACILITY: PORTS / X-326 L Cage and X-7725 Waste Storage Unit

VULNERABILITY NUMBER: 5

c. Mitigating Practices

These waste streams are extremely unlikely to react. The waste solvents, oils/solvents, or generator solutions are not generated with metals and halogenated organics mixed together; rather, the solvents, oils/solvents, and generator solutions are contaminated with metal residue.

Solvents and oils/solvents are shipped to the incinerator at Oak Ridge, Tennessee on a monthly basis. Each shipment averages 25, 000 pounds. The generator solutions require further stabilization prior to treatment.

The remaining waste containers are stored in an area surrounded by a six-inch dike. Each storage area is inspected on a weekly basis to ensure container and facility integrity. In the event that a container is found to be leaking, immediate corrective action is performed and final corrective action is completed within twenty-four hours. No liquid wastes are overpacked. If a liquid waste container requires repair, then the container contents is transferred to a new container.

Appendix A

SITE / FACILITY: PORTS / X-326 L Cage and X-7725 Waste Storage Unit

VULNERABILITY NUMBER: 6

1. BRIEF DESCRIPTION OF VULNERABILITY

Potential incompatibilities of containers placed into long-term storage for waste stream Cascade-6, *Decontamination Waste Solids*.

2. SUMMARY OF VULNERABILITY

Decontamination work sometimes results in solid waste generation such as sludge or debris. The solids be contaminated with very small amounts of heavy metals. The solids are not mixed with organics; rather, decontamination processes result in some organic contamination.

The solids may exhibit very low levels of organics and metals.

3. BASIS

a. Reference

EPA Publication 600/2-80-076, *A Method for Determining Compatibility of Hazardous Wastes*.

PORTS' Resource Conservation and Recovery Act Part B Permit

b. Potential Consequences

If incompatible wastes would come into contact with each other, then heat or explosion may occur.

SITE / FACILITY: PORTS / X-326 L Cage and X-7725 Waste Storage Unit**VULNERABILITY NUMBER:** 6**c. Mitigating Practices**

The waste containers are stored in an area surrounded by a six-inch dike. Each storage area is inspected on a weekly basis to ensure container and facility integrity. In the event that a container is found to be leaking, immediate corrective action is performed and final corrective action is completed within twenty-four hours. No liquid wastes are overpacked. If a liquid waste container requires repair, then the container contents is transferred to a new container.

Appendix A

SITE / FACILITY: PORTS / X-326 L Cage and X-7725 Waste Storage Unit

VULNERABILITY NUMBER: 7

1. BRIEF DESCRIPTION OF VULNERABILITY

Nitric Acid and Uranyl Nitrate concentrations in legacy waste, waste stream 710-2A, *Waste Laboratory Acids*

2. SUMMARY OF VULNERABILITY

The X-710 laboratory uses nitric acid in various wet chemistry procedures. The laboratory purchases nitric acid in one-gallon size bottles. The concentration of the reagent grade nitric acid is approximately 69% by weight. The majority of the laboratory procedures require the nitric acid to be diluted. The diluted nitric acid concentration ranges between 12% and 17% by weight. In addition to the nitric acid, other acids are used in other laboratory procedures. After use, all acids are mixed into a single waste container. As a result, the nitric acid concentration in the waste acid is further diluted.

Analysis to determine exact concentrations of nitric acid in a given waste container is not performed. Analysis of waste container contents to determine overall nitrate concentration may be performed and the nitric acid concentration may then be inferred from the overall nitrate concentration. Current plans and budgeted funds do not include performing this analysis.

The typical uranium concentration ranges between 1 and 20 mg/l; however, a single maximum measurement of 401 mg/l was attained from the waste stream. Inferring from the uranium concentration, the typical uranyl nitrate concentration in the waste laboratory acid is less than 34 mg/l.

Therefore, the expected nitric acid concentration in the laboratory waste acid is between 12% and 17 % by weight; the expected uranyl nitrate concentration is less than 34 mg/l.

3. BASIS

a. Reference

PORTS Process Knowledge Waste Identification Report, Waste Stream 710-2A & 710-2B, *Waste Acid / Bases*

PORTS' Resource Conservation and Recovery Act Part B Permit

SITE / FACILITY: PORTS / X-326 L Cage and X-7725 Waste Storage Unit

VULNERABILITY NUMBER: 7

b. Potential Consequences

Generation of gas leading over-pressurization of drum and potential rupture.

c. Mitigating Practices

The waste containers are stored in an area surrounded by a six-inch dike. Each storage area is inspected on a weekly basis to ensure container and facility integrity. In the event that a container is found to be leaking, immediate corrective action is performed and final corrective action is completed within twenty-four hours. No liquid wastes are overpacked. If a liquid waste container requires repair, then the container contents is transferred to a new container.

Appendix A

SITE / FACILITY: PORTS / X-326 L Cage and X-7725 Waste Storage Unit

VULNERABILITY NUMBER: 8

1. BRIEF DESCRIPTION OF VULNERABILITY

Nitric Acid and Uranyl Nitrate concentrations in legacy waste, waste stream 700-8, *Nickel Stripping Solution*

2. SUMMARY OF VULNERABILITY

Waste Stream 700-8, Nickel Stripping Solution

As part of the plant maintenance program, nickel was stripped from component parts prior to refurbishing. The X-700 facility purchased agricultural grade nitric acid at a concentration of nominally 55% by weight. No dilution of the nitric acid was performed. By procedure, the nitric acid was discharged when the concentration dropped below 50% by weight.

Analysis to determine exact concentrations of nitric acid in a given waste container is not performed. Analysis of waste container contents to determine overall nitrate concentration may be performed and the nitric acid concentration may then be inferred from the overall nitrate concentration. Current plans and budgeted funds do not include performing this analysis.

The content of the single container of the nickel stripping solution in storage measures the uranium concentration as 18 mg/l. If the uranium exists as a uranyl nitrate, then the maximum uranyl nitrate in the container is approximately 30 mg/l. The resulting uranyl nitrate mass is approximately 4.24 grams.

Therefore, the expected nitric acid concentration in the single container of waste nickel stripping solution is at least 50% by weight; the expected uranyl nitrate concentration is approximately 34 mg/l.

3. BASIS

a. Reference

PORTS Process Knowledge Waste Identification Report, Waste Stream 700-8, *Nickel Stripping Solution*

PORTS' Resource Conservation and Recovery Act Part B Permit

SITE / FACILITY: PORTS / X-326 L Cage and X-7725 Waste Storage Unit

VULNERABILITY NUMBER: 8

b. Potential Consequences

Generation of gas leading over-pressurization of drum and potential rupture.

c. Mitigating Practices

The waste containers are stored in an area surrounded by a six-inch dike. Each storage area is inspected on a weekly basis to ensure container and facility integrity. In the event that a container is found to be leaking, immediate corrective action is performed and final corrective action is completed within twenty-four hours. No liquid wastes are overpacked. If a liquid waste container requires repair, then the container contents is transferred to a new container.

Appendix A

SITE / FACILITY: PORTS / X-326 L Cage and X-7725 Waste Storage Unit

VULNERABILITY NUMBER: 9

1. BRIEF DESCRIPTION OF VULNERABILITY

Storage of reactive wastes.

2. SUMMARY OF VULNERABILITY

PORTS stores

3. BASIS

a. Reference

No listed references - interview with site personnel with particular expertise in this area.

b. Potential Consequences

Generation of gas leading over-pressurization of drum and potential rupture.

SITE / FACILITY: PORTS / X-326 L Cage and X-7725 Waste Storage Unit**VULNERABILITY NUMBER:** 9**c. Mitigating Practices**

The waste containers are stored in an area surrounded by a six-inch dike. Each storage area is inspected on a weekly basis to ensure container and facility integrity. In the event that a container is found to be leaking, immediate corrective action is performed and final corrective action is completed within twenty-four hours. No liquid wastes are overpacked. If a liquid waste container requires repair, then the container contents is transferred to a new container.